

with it the entire long train of physical terms that are united with it." As there are already ninety-one formulæ when the end of chap. i. is reached, and they are, to say the least, of controversial application, those who are not looking for trouble may be disposed to pass by on the other side. One recalls the "great text in Galatians, Once you trip on it entails, Twenty-nine distinct damnations, One sure if another fails." But such a pusillanimous attitude is not permitted to a reviewer. He has to make up his mind whether the compressed mass of 117 tables and 380 formulæ which the book contains do in fact add light or darkness to the problems of the sun.

The book is a discussion, a contribution to theory; the observations upon which it is based are chiefly those of Mr. Abbot, with the pyrheliometer, but Prof. Bigelow contends that Mr. Abbot's results are erroneously reduced, so that whereas Mr. Abbot concludes a rise of intensity of solar radiation from 1.50 calories per square centimetre at sea-level to 1.94 at the confines of the earth's atmosphere, Prof. Bigelow, using the same observations, says that the latter figure should be raised to 3.98 calories. On p. 376 he remarks: "There is probably no apparatus more difficult to interpret correctly than is the pyrheliometer, because it demands a full knowledge of radiation in gases, in glass, in mercury, in metals, during variable transformations, in which the kinetic, potential, expansion, and free-heat energies are all undergoing mutual readjustments." One may well say so, if doctors disagree to that extent. On p. 210 is a *résumé* of the results of twelve different lines of computation, every one of which gives values between 3.92 and 4.08. This would naturally be very impressive, and one would wish to confirm it by recalculating a few of the numbers. But they are not of the kind that admits of this. One must accept them from the author, and without questioning at all their correct derivation from his formulæ, it must be said these formulæ are of a kind to give one most serious pause. They are, indeed, put forward as revolutionary. On p. 1 we read: "In the Boyle-Gay Lussac Law, $P = \rho RT$, all the terms, including the gas efficiency R , are variable." But if R is not constant, all accepted gas theory, and a great deal of the structure of general physics, tumble down in ruins. On p. 17 is given a list of quantities which must also be variable; they include among them the number of molecules per unit mass of any gas. On p. 129 we read: "The entire thermodynamics of radiation must be based upon a series of non-adiabatic variable coefficients, instead of a set of adiabatic constants, as has been assumed in previous discussions." It cannot be expected that we should make such a change without the most imperative reasons and the most direct and exhaustive proofs of its necessity. But these are wanting. The reasons given in two or three sentences, on p. 16, are certainly not convincing or inevitable. The accepted gas theory is not inadequate to explain, for example, iso-

thermal strata in the earth's atmosphere. But Prof. Bigelow's new doctrine occupies his field of view so exclusively that the whole of his book, upon which immense labour must have been spent, stands or falls with it.

R. A. S.

OILS, FATS, AND WAXES.

Technical Handbook of Oils, Fats, and Waxes. By P. J. Fryer and Frank E. Weston. Vol. ii. "Practical and Analytical." (The Cambridge Technical Series.) Pp. xvi+314. (Cambridge: At the University Press, 1918.) Price 15s. net.

THE events of the last four years have directed attention to the economic importance of the edible oils and fats, and also to that of fats in general, as being the source from which glycerin is obtained. The national value of the industry which deals with these products is now pretty widely recognised. Fundamentally it is a chemical industry, and a knowledge of the chemistry of the oils, fats, and waxes will tend to become more and more desirable for those who control it on the technical side.

Messrs. Fryer and Weston may fairly claim to have assisted in the spread of such knowledge. In an earlier volume they have described the general chemistry of the oils, fats, and waxes, and the general principles of the methods of analysis used in the examination of these products. The present work is concerned with the practical application of those principles. It appears to be largely intended for technical chemists, but students are also within its purview. Of this we are reminded every now and then by the italicised note: "*Students should cleanse all apparatus in hot soft soap solution. . . .*" One seems to remember those students!

Both classes of users will find the volume very helpful. All the usual methods of analysis are described, with recent improvements and developments, and there are plenty of practical hints and notes.

The earlier parts of the book "begin at the beginning" with descriptions of apparatus and methods of manipulation, whilst the important matter of proper sampling receives due attention. In explaining the "standard" analytical determinations, the general plan adopted is to start with a definition, give a short outline of the method, offer remarks upon it, and describe the apparatus and materials required, before going on to the actual experiments. The directions are categorical, and are couched in a mood which may be characterised as the abbreviated imperative: "Dissolve dry fatty acids . . . decant off alcohol . . . distil off ether." A number of photographs of apparatus are included in the text.

Among the best and most important of the sections is the one which deals with the interpretation of the results obtained in the analyses. It is one thing to be able to carry out experiments on oils, fats, and waxes; it is quite another to know what the results really indicate. The authors discuss this question in some detail. They

point out how the same product may vary through differences of climate, feeding, methods of refining, and so on; and they then show by examples what deductions may legitimately be drawn from the experimental data.

The substances dealt with include hydrocarbon oils and waxes, rosin, turpentine, soap, glycerin, and candle material, as well as the animal and vegetable oils, fats, and waxes. The book appears to be well "up to date," and can be recommended as a very useful addition to the technical chemist's library. C. S.

OUR BOOKSHELF.

Jays of the Open Air. By William Graveson. Pp. 115. (London: Headley Bros., Ltd., n.d.) Price 3s. 6d. net.

To the town-dweller who has a longing for the countryside, more especially in the dull, damp early months of the year, when spring seems so long in coming, the chapters of this little book will serve as a tonic. Mr. Graveson is a man who loves his garden and his bird-visitors, as well as the meadows, woods, and chalk-downs beyond; he has eyes that can see, and above all he has the faculty of expressing what he sees and feels in simple, charming language.

In this delightful little volume he has jotted down some of his experiences during the months from February to September of last year. He shows how, when exactions of business and various duties curtail hours of recreation, and difficulties of travel prevent holidays from being taken far afield, there are opportunities for seeking new pleasures in familiar surroundings. The rambles described in his book have been in the compass of a half-holiday walk and not more than five miles of a country town within easy distance of London. The arrangement is chronological. Chap. i., "The Haunt of the Kingfisher," describes a bright morning early in the year when the hoarfrost lies thick on the common. "The Promise of Spring" (chap. ii.) recalls the coming of the winter aconite, the crocus, and other harbingers of spring. "The Incoming of Spring" is an epic of a sunny Palm Sunday—daffodils and scillas are out in the garden, a silky-coated Pasqueflower is preparing for its Easter display, and a bright red anemone for the warm April days; and never have the almonds looked more beautiful. And so on through the book to "Foxgloves and Fairies" and "The Lure of the Heather," which are the headings of the two last chapters.

The illustrations, photographic reproductions—a stream choked with water-violet, a bed of winter aconites, a cowslip meadow, and a few others—add to the charm of this series of Nature pictures.

Submarine and Anti-Submarine. By Sir Henry Newbolt. Pp. viii+312. (London: Longmans, Green, and Co., 1918.) Price 7s. 6d. net.

SIR HENRY NEWBOLT has succeeded in presenting a very fair view of the work of our submarines and of the measures taken to meet the U-boat menace. Despite the fact that a great deal of

further information has been published since the date of the armistice, the book will be found to be useful on account of the connected presentment. Opening with the evolution of the submarine and a description of the submarine of to-day, the author passes to the methods of the submarine in attacking warships, and the means taken by warships in meeting attack and in aggressive action. The work of our submarines in the Baltic and in the Dardanelles occupies a large section of the volume, and the work of our trawlers, destroyers, P-boats, and Q-boats is well described. The book closes with an account of the Zeebrugge and Ostend attacks.

One interesting aspect of the submarine campaign is a knowledge of the feelings of the hunted during the chase. This is dealt with in chap. xvi., by quoting a long extract from the "War Diary of U 202," by Lt.-Commdr. Freiherr Spiegel von und zu Peckelsheim. Sir Henry Newbolt comments on the extract by saying that it is not unnatural that von Peckelsheim should enlarge upon his terror at the moment and his self-congratulation afterwards. But his diary contrasts badly with reports from our own submarine commanders in worse circumstances. "We may take pleasure in noting that the steadiness of nerve and the scientific view are in our favour."

Aids in Practical Geology. By Prof. Grenville A. J. Cole. Seventh edition, revised. Pp. xvi+431. (London: Charles Griffin and Co., Ltd., 1918.) Price 10s. 6d. net.

THERE are few living authors who take so wide a view of the phenomena and problems of geology as Prof. Cole, and none who is more capable of making the subject of interest to the student. He stands out, too, among his contemporaries in his appreciation of the work of the pioneers of the science, and in particular of the French petrologists of the first half of the nineteenth century, especially of Cordier and Delesse. He gives an interesting record of the latter's procedure in determining the volumetric mineral composition of a rock by the measurement of areas on a polished slab, and explains how it may be applied to sections under the microscope. Prof. Cole does not, however, refer to the linear method in which the same result is obtained by the measurement of the mineral intercepts on lines drawn over the surface. This method, which has largely superseded the area method in microscopic work, was described by Delesse in the same paper, though the credit for it is usually given to Rosiwal, who published an account of it just fifty years later in 1898.

In the limited space at the author's disposal it was impossible to include everything he might have wished, but perhaps in a new edition he will endeavour to find room for the shadow (Schröder van der Kolk) method of determining under the microscope the refractive index of grains or fragments relatively to the medium in which they are immersed. It is at once very simple and easily applied J. W. EVANS.